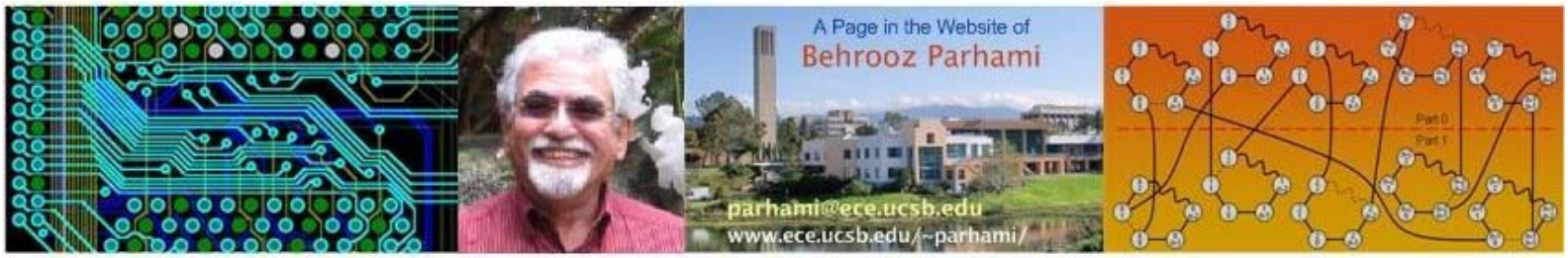
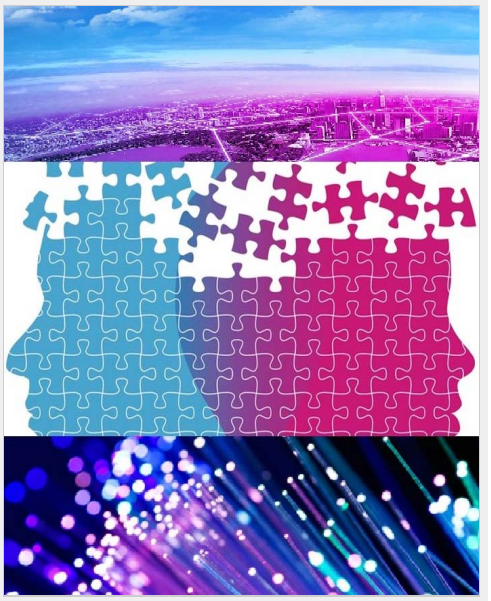


- Home & Contact
- Curriculum Vitae
- Research
  - Computer arithmetic
  - Parallel processing
  - Fault tolerance
  - Broader research
  - Research history
  - Research collab
  - List of publications
- Teaching
  - ECE1B Freshman sem
  - INT94TN Frosh sem
  - ECE154 Comp arch
  - ECE252B Comp arith
  - ECE252C Adv dig des
  - ECE254B Par proc
  - ECE257A Fault toler
  - Student supervision
  - Math + Fun!
- Textbooks
  - Computer arithmetic
  - Parallel processing
  - Dependable comp
  - Comp architecture
  - Other books
- Service
  - Professional activities
  - Academic service
  - Community service
  - Industrial consulting
- Files & Documents
- Useful Links

Behrooz Parhami's INT 94TN Course Page for Fall 2016

Puzzling Problems in Science and Technology



Page last updated on 2016 December 02

Note: This is a new freshman seminar, first offered in fall 2016
Enrollment code: 58446
Prerequisite: Open to freshmen only
Class meetings: W 3:30-4:20, Buchanan 1934
Instructor: Professor Behrooz Parhami
Open office hours: M 12:00-2:00, W 4:30-5:30, HFH 5155
Course announcements: Listed in reverse chronological order
Grading scheme: Pass/Fail grade assigned based on attendance
Course calendar: Schedule of lectures and links to lecture slides
The ten lectures: Lecture summaries and references
Additional topics: Possible replacements for current lectures
Attendance record: Please check regularly for possible errors
Miscellaneous information: Motivation, catalog entry, history
[The design and goals of this seminar resemble those of **ECE 1B**, "Ten Puzzling Problems in Copmuter Engineering."]

Course Announcements

2016/12/02: The fall 2016 offering of the freshman seninar INT 94TN is officially over and course grades have been reported to the Registrar. I enjoyed preparing new material for this seminar, teaching it, and getting to interact with students from several majors not normally taking my ECE Department courses. Have a great holiday break and hope to see some of you in future courses or around the campus!

If you have time during the holidays, here is an interesting math puzzle for you to tackle: Three runners of widely varying abilities set out around a 400-meter track. The lap times for the runners are 78, 104, and 156 seconds, which remain the same throughout the race. When the first runner wins upon reaching the finish line, he notices that for the first time, both of the other two runners are exactly abreast of him. How many laps was the race, and what was the winning time? [From: *E&T* magazine, issue of March 2016]

2016/11/30: Some grades and oral final exam schedules have been posted to the attendance area below. Please take a look and contact me right away if you do not see a grade or an exam schedule adjacent to your Mrep number.

2016/11/23: Today, we discussed maps and graphs in class and noted that many problems, such as map-coloring and maze-solving, can be converted to graph problems. Happy Thanksgiving Day to everyone and here is a **turkey maze** for you to solve after the big meal! Please send me your written explanation for any absences you might have had, no later than next Wednesday 11/30.

2016/10/06: Following an article in *UCSB Current* last week, UCSB's student paper, *Daily Nexus*, has also covered our freshman seminar as a **science/technology feature** in its October 6, 2016, issue.

2016/09/28: Here is a link to the ***UCSB Current* article** about "cool classes," ours and one taught by Professor Daryl Cooper of the Math Department. Attendance record for today's lecture has been posted near the end of this page.

2016/09/25: I am looking forward to meeting all 20 enrolled students on W 9/30. Presentation slides and handouts for the first two lectures have been posted to this page.

2016/05/09: Welcome to the INT 94TN Web page for fall 2016. Please read the grading scheme below very carefully to ensure that you can earn a "pass" grade at the end of the quarter. INT 94TN requires no textbook and has no homework assignments or exams. A worksheet handout is given out at the beginning of each lecture

Personal
- Blog & books
- Favorite quotations
- Poetry
- Pet peeve
- Virtual retirement

CE Program
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and complete lecture slides are made available on-line. Please report any broken hyperlink to the instructor.

Grading Scheme

Pass/Not-Pass grading is based on attendance and class participation. There will be no homework or exam.
0 absence: Automatic "Pass."
1 absence: "Pass" if you submit a written statement to explain the absence. Any explanation is acceptable.
2 absences: Can earn a "Pass" grade by taking an oral final exam covering the two missed lectures.
3 or more absences: Automatic "Not-Pass."
Attendance will be taken 10 minutes into the class session and recomfirmed just before dismissal. If you have to leave early, please see the instructor before class to state your reasons and make appropriate arrangements.

Course Calendar

Course lectures have been scheduled as follows. PowerPoint presentations (up to 2+ MB), and equivalent PDF files, are updated periodically. Please note that any animation in PowerPoint presentations is lost in the PDF versions. Before downloading the slides, check the "last updated" date to make sure you have the latest files for 2016. This schedule will be followed strictly. You can refer to the **Web page for ECE 1B** for additional topics presented in the same style.

Day & Date (Lecture slides, ppt + pdf, and ppt handout) Lecture title
W 09/28 (**ppt**, **pdf**, **handout**, last updated 2016/09/25) Predicting the Future: Puzzles
W 10/05 (**ppt**, **pdf**, **handout**, last updated 2016/09/25) Predicting the Future: Sci/Tech
W 10/12 (**ppt**, **pdf**, **handout**, last updated 2016/10/09) Recommender systems: Puzzles
W 10/19 (**ppt**, **pdf**, **handout**, last updated 2016/10/09) Recommender systems: Sci/Tech
W 10/26 (**ppt**, **pdf**, **handout**, last updated 2016/10/23) 3D models from 2D images: Puzzles
W 11/02 (**ppt**, **pdf**, **handout**, last updated 2016/10/23) 3D models from 2D images: Sci/Tech
W 11/09 (**ppt**, **pdf**, **handout**, last updated 2016/11/04) Computational geometry: Puzzles
W 11/16 (**ppt**, **pdf**, **handout**, last updated 2016/11/04) Computational geometry: Sci/Tech
W 11/23 (**ppt**, **pdf**, **handout**, last updated 2016/11/20) Maps and graphs: Puzzles
W 11/30 (**ppt**, **pdf**, **handout**, last updated 2016/11/20) Maps and graphs: Sci/Tech

Summary and References for the Ten Lectures

Lecture 1: Predicting the future: Puzzles
Sloane, N.J.A., "Find the Next Term," *J. Recreational Mathematics*, 1974 [**GIF**]
Sloane, N.J.A., ***Online Encyclopedia of Integer Sequences***
Solution methods for numerical series, including polynomial extrapolation
Solution methods for non-numerical series

Lecture 2: Predicting the future: Sci/Tech
Technology forecasting: Firat, A. K., W. L. Woon, and S. Madnick, "Technological Forecasting—A Review," Working Paper CISL#2008-15, MIT's Sloan School of Management, September 2008.
Inventory forecasting
Stock-market prediction
Program branch prediction

Lecture 3: Recommender systems: Puzzles
Finding similarities and differences among images
Which item isn't like the others or most similar to the others?
Solution methods for similarity puzzles
Pattern classification, using one or more features

Lecture 4: Recommender systems: Sci/Tech
Fingerprint matching
Image search
Recommender systems basics (**Book chapter**)
Mining massive datasets (**YouTube videos**) [See in particular video 5.1]

Google's page-rank algorithm

Lecture 5: 3D models from 2D images: Puzzles
2D projections of 3D objects (**Image**)
Projections of assemblies made from cubic blocks
Isometric and various views; front, top, right (**Image**)
Deducing 3D geometric objects from 2D drawings
Visible and invisible elements in 2D views

Lecture 6: 3D models from 2D images: Sci/Tech
3D illusion in 2D drawings (sidewalk art)
3D body scans
Modeling of industrial parts and assemblies, such as cars and planes
Architectural visualization
Modeling of historical sites in danger of collapse or destruction
Models built from layers, and 3D printing

Lecture 7: Computational geometry: Puzzles
Tricks and optical illusions
Intersecting and touching geometric shapes
Tiling the plane
Web site devoted to discrete and computational geometry [**The Geometry Junkyard**]

Lecture 8: Computational geometry: Sci/Tech
Dot-matrix printing
Drawing lines and other geometric shapes
Hidden line removal
Hidden surface determination and shading
Robot path planning with obstacles

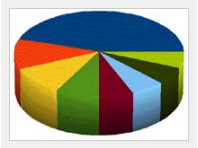
Lecture 9: Maps and graphs: Puzzles
Graph colorings
Graph isomorphism
The bridges of Konigsberg puzzle
Shortest-path problems
Feeman, T.G., *Portraits of the Earth: A Mathematician Looks at Maps*, American Mathematical Society, 2002

Lecture 10: Maps and graphs: Sci/Tech
Google Maps
GPS and its applications (e.g., ground and structure movements, navigation)
Routing and scheduling
The traveling salesperson problem
Resource-placement problems

Additional Lecture Topics for Possible Future Use

Spare topic: Reliability engineering
Puzzles based on probability
The black-swan effect: events with extremely low probabilities
Probability brain-teasers

Student Attendance Record



In the following table, absence is marked with a "1" and presense with a "0". The first ten columns correspond to Lectures 1-10, the next column, **Σ**, is the total number of absences, and "Mrep" is the first few digits of the reversed Perm Number. For example, a student with the Perm Number 9876543 will have a Mrep code of 3, 34, 345, 3456, ... , depending on whether other students have Perm Numbers with the same ending.

Attendance record updated after lecture 10 on W 11/30.

1	2	3	4	5	6	7	8	9	0	**Σ**	Mrep	Notes about attendance, oral final exam, and grade
0	0	0	0	0	0	0	0	1	0	**1**	0	Pass
0	0	0	0	0	0	0	0	0	0	**0**	1	Pass
0	0	0	0	1	0	0	0	0	0	**1**	23	Pass
0	0	1	0	1	0	0	0	1	0	**3**	266	Pass (based on oral final exam on R 12/1, 4:00 PM)
0	0	0	0	0	0	0	1	0	0	**1**	268	Pass
0	0	1	0	0	0	0	0	0	0	**1**	4	Pass
0	0	0	0	0	0	0	0	0	0	**0**	50	Pass
0	0	0	0	0	0	0	0	0	0	**0**	560	Pass
0	0	0	0	0	0	0	0	0	0	**0**	564	Pass
0	0	0	0	0	0	0	0	1	0	**1**	58	Pass
0	0	0	0	1	0	0	0	0	0	**1**	60	Pass
0	0	0	0	0	0	0	0	0	0	**0**	62	Pass
0	0	0	0	0	0	0	0	0	0	**0**	68	Pass
0	0	0	0	0	0	1	0	1	0	**2**	69	Pass (based on oral final exam on F 12/2, 1:30 PM)
0	0	0	0	0	0	0	0	0	0	**0**	7	Pass
0	0	0	0	0	0	0	0	0	0	**0**	8	Pass
1	1	0	0	0	0	0	0	0	0	**2**	950	Pass (based on oral final exam on R 12/1, 3:30 PM)
0	0	0	0	0	1	0	0	0	0	**1**	951	Pass
0	0	0	0	0	0	0	0	0	0	**0**	961	Pass
0	0	0	0	0	0	0	1	0	0	**1**	966	Pass

Miscellaneous Information

Motivation: Whether they work in the industry or in academic research settings, scientists and engineers face many challenges in the discovery and advancement of new theories and in the quest to design complex structures and processes that are both reliable and usable. It is difficult to discuss these topics at the freshman level, given the lack of background in the requisite subjects. This seminar is intended to provide an introduction to day-to-day problems and research endeavors in science and technology via their connections to familiar mathematical and logical puzzles.

Catalog entry: **INT 94TN. Puzzling Problems in Science and Technology. (1) PARHAMI.** 1 hour/week.
Prerequisite: Open to UCSB freshmen from all disciplines.
Restrictions: Subject to campus rules for interdisciplinary freshman seminars.
Scientific research and technological development problems are puzzle-like in the sense of requiring insight and out-of-the-box thinking for their solution. Many such problems are actually related to popular math/logic puzzles in terms of the pertinent insights and solution methods. In this 1-unit seminar, several puzzles are introduced and linked to science/technology topics. Examples include "finding the next term in a series" (technology forecasting, program branch prediction), "detecing similarities and differences in images" (fingerprint matching, recommender systems), and "deducing 3D shapes from 2D images" (body imaging, architectural models).

History: This seminar came about as an extension of a 1-unit seminar, proposed and designed by Professor Parhami for computer engineering students (first offered in spring 2007 as ECE 1, later becoming ECE 1B). The main goal of both seminars is to expose students to challenging problems, faced by engineers and research scientists, in a motivating and entertaining way, while requiring a minimal background in math and science.
Web page for ECE 1B